

(18)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets

(11) Publication number:

**0 046 922**  
**B1**

(12)

## EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **06.06.84**

(51) Int. Cl.<sup>3</sup>: **B 65 D 41/50**

(21) Application number: **81106405.4**

(22) Date of filing: **18.08.81**

(54) **Cap.**

(30) Priority: **26.08.80 SE 8005957**

(43) Date of publication of application:  
**10.03.82 Bulletin 82/10**

(45) Publication of the grant of the patent:  
**06.06.84 Bulletin 84/23**

(84) Designated Contracting States:  
**AT BE CH DE FR GB IT LI NL SE**

(56) References cited:  
**AT - B - 115 300**  
**AT - B - 351 383**  
**CH - A - 613 172**  
**DE - C - 719 521**  
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Courier Press, Leamington Spa, England.

**EP 0 046 922 B1**

## Description

The present invention relates to a cap for containers intended for the keeping of pressurized contents such as beer or refreshing beverages, according to the opening part of claim 1.

Such cap is known (CH—A 613 172) and overcomes problems of screw caps, stopperlike caps of the cork type, and tear-off metal caps, in connection with bottles and other containers intended for pressurized contents. In the packaging of pressurized contents a need exists to provide a cap which for one thing is tight in respect of gases which are wholly or partially dissolved in the contents, in particular carbon dioxide, which secondly is mechanically so stable that it is retained without substantial deformation in the opening of the container, thirdly is relatively easy to open, and lastly is inexpensive to manufacture and easy to apply to the container. In particular for non-returnable containers of plastics it has been found, however, that the available known cap constructions are not satisfactory, largely because of the elasticity of the plastic material. There arise problems during manufacturing and handling.

It is an objective of the invention to assure that the metal foil of the disc will not be destroyed during inserting the cap into the opening of the container. The cap shall not affect the content and filling goods of the container.

According to the invention the cap is provided with an annular recess at the edge zone of the lower part of the tubular body whose diameter coincides or slightly exceeds the diameter of the disc which is fitted into said recess, and that the outer edge of the disc is completely encapsulated by a protective coating.

According to the invention the disc is surrounded, at its outer edge, by a portion of the edge zone of the tubular body. As a result thereof, the invention comprises a double function:

1. The risk of disattachment of the disc from the tubular body during inserting the cap into the container's opening will be avoided, as radial forces along the disc will be transferred to the edge zone of the tubular body covering the outer edge of the disc.
2. The outer edge of the disc being made by cutting the metal foil is well protected by plastic material, especially by thermoplastic material, so that the content of the container cannot come into contact with this outer edge, thereby avoiding any chemical reaction between the content and the metal as well as badly affecting the taste of the content.

Furthermore, such "recess" facilitates the connecting of the disc to the tubular body and the stopperlike part even in case of a small

annular portion of compact surface between the disc and the tubular body. Therefore, the invention comprises a lot of advantages solving the present problem.

According to a further embodiment the disc is coated on either side with a thermoplastic material, this coating layer in the edge zone of the metal foil disc being pressed out a little with the help of heat and pressure over the edge zone of the metal foil disc and induced to combine together by fusion, encapsulating at the same time the cut edge zone of the metal foil disc.

An embodiment of the invention is described in the following schematic drawings wherein

Fig. 1 shows a cross-section of the cap which is inserted in a container opening, the sealing disc of metal foil being fitted into an annular recess, and

Fig. 2 shows a detail of the portion ringed in Fig. 1.

In Fig. 1 is shown a cap of a type in accordance with the invention, which cap is fitted into a container 4 which has an opening whose mouth portion comprises an annular, inwardly directed lip 5. The container 4 can be made of glass, plastics or sheet metal and can be of optional shape with the exception of the inwardly directed lip 5.

The cap is made of an elastic material, preferably a thermoplastic such as polyethylene, and the most rational method for the manufacture of the cap consists in the application of a so-called injection moulding process.

The cap consists of a single coherent plastic part which comprises an outer tubular body 3 and an inner stopperlike part 1. The outer tubular body 3 is provided in its lower part 14 with a hooklike flange 6 and in its upper part with a flexible flange 8 which is larger than the flange 6. On the outside of the tubular body 3 between the said flanges 6 and 8 sealing devices in the form of flexible, deformable sealing elements or projections 7 are arranged. The inside 27 of the tubular body 3 is adapted so as to form a pouring channel for pouring out of the contents of the container 4. The inside 27 may suitably be made slightly tapering so as to facilitate the manufacturing process of the cap. The inner, stopperlike part 1 can also be made with slightly tapering side walls and a suitable angle of inclination is 4°.

The stopperlike part 1, moreover, has a base 2 and a projecting portion 12 joined to the base 2 with a free end surface 15. The stopperlike part 1 is joined along the thin and easily breakable circular portion 19 to the upper part of the tubular body 3, and it is also joined to the outer part of the flange 8 along a short connecting zone 11, which is situated opposite a gripping part 16 with a pull-ring, this gripping part 16 being connected to a part of the edge zone of the flange 8. For the fastening of the stopperlike part 1 on the tubular body 3 after the connecting zone 11 has been broken up, the

gripping part 16 is provided with a catch 9 known in itself which is adapted so that it engages under the flange 8. The lower end surfaces 28, 15 of the tubular body 3 and an annular projecting portion 12 of the stopperlike part 1 respectively are not in the same plane but are joined to one another by means of a gas-tight disc 13, preferably of aluminium foil, which bridges the space 18 between the tubular body 3 and the part 1. To facilitate the fixing of the disc to the lower part 14 of the tubular body 3 and to the free end surface 15 of the annular projecting portion 12, the aluminium foil disc 13 is provided with a coating which has good adhesion to the aluminium foil disc 13, and which can be made to fix onto the cap along the surface 15 and the surface of an annular recess 20 in said lower part 14, preferably through the application of heat with simultaneous exertion of pressure. Such a coating preferably may be constituted of a polyethylene layer, but it is also conceivable to use a so-called hot-melt, that is to say a melting glue or a hot-sealable varnish. Since the aluminium foil material is chemically attacked by acids which occur e.g. in fruit juices, it is necessary in certain cases to coat both sides of the aluminium foil disc 13 with thermoplastic material.

Owing to the concentric annular fixing surface 15 and of the recess 20 and to the relatively narrow aluminium foil disc 13 the energy required for the sealing operation can be substantially reduced.

If the area of the unsupported part 17 of the aluminium foil disc 13 is too large, the forces emanating from the pressure inside the container 4 onto this part of the disc 13 will become so great that the disc 13 can burst. This is a problem, especially within the area 17, since the volume of the wedge-shaped compressible space 18 is relatively large, whereas the problem does not arise to any appreciable extent in the central, unsupported portion of the aluminium foil disc 13, as the distance between the base 2 of the cap and the disc is small (approx. 0.5 mm) and the compressible volume of the space behind the disc 13 is consequently small.

It has been found that the thickness of the disc has to be adapted to the size of the area 17, and for containers with an opening diameter of 20—25 mm it has been possible to establish empirically that the ratio A between the inside diameter of the lower part of the tubular body 3 and the outside diameter of the annular portion 12 of the stopperlike part 1 should be between 1.2 and 2, preferably 1.25. Moreover, it has been possible to establish that the thickness T of the aluminium foil disc 13 ought to be between 5 and 25  $\mu$ ; T having to be at least  $5+10 \times A$  with a tolerance of  $\pm 25\%$ . Naturally any plastic coatings on the aluminium foil disc 13 will also to a certain extent contribute to its strength. However, the effect is not so great insofar as the occurrence of bursts in

the aluminium foil disc 13 is concerned, since the plastic material of the coating layers has a completely different modulus of elasticity from the aluminium material. This means that at a relatively small extension the aluminium foil disc 13 may already break, before the plastic coating, owing to its greater elasticity, has been able to make any significant contribution to the rupture strength of the aluminium foil disc 13.

The rules concerning the thickness of the aluminium foil disc 13 given here are intended only to serve as a guideline in the dimensioning of the disc 13. The dimensioning may be modified within relatively wide limits, taking into account such factors as the pressure in the container 4, the quality of the aluminium foil disc 13, the diameter of the container mouth etc.

After the filling of the container 4 with the intended contents, e.g. beer or carbonated fruit juice (so-called lemonade), the cap is pressed into the opening of the container 4, the lower tapered portion 26 of the outer tubular part 3 facilitating the guiding and introduction of the cap into the container mouth. As the cap is pressed in, the lower flange 6 of the tubular body 3 will be pressed past, and, thanks to its flexibility, will snap over the lower edge of the inwardly directed lip 5 of the container 4 at the same time as the upper flange 8 of the tubular body 3 will come to rest against the upper edge of the container mouth in such a manner that the inwardly directed lip 5 is firmly fixed between the flanges 3 and 8, at the same time as the outside of the lip 5 is pressed against the corresponding sealing element 7 of the cap.

It is preferred that the container 4 is manufactured from a material of good gas barrier properties, in particular with regard to oxygen and carbon dioxide, e.g. glass, sheet metal or a relatively gastight plastic material, such as acrylonitrile plastic of the type which is marketed under the trade name Borex or polyester (possibly with PVC coating).

As mentioned earlier it is most appropriate to injection-mould the cap in polyethylene material, which material unfortunately has, relatively speaking, poor gas barrier properties, and an injection-moulded polyethylene cap of the type shown in Fig. 1 causes large gas losses, especially along the thin, tearable portion 19, if the cap is not provided with any gastight cover disc 13. However, if a disc 13 of especially aluminium foil is fitted on the cap in the manner which has been specified, the gas leakage through the cap can be radically restricted and the contents in the container 4 are better protected against deterioration of quality, or in other words the shelf life of the package can be extended.

When the contents in the container are to be made accessible to the consumer, the gripping part 16 is pulled upwards and prized over the mouth of the container 4 in that it is "folded" along the straight weakening groove 10 which

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is arranged transversely across the cap. Owing to the upper part of the cap being folded or brought down over the groove 10, the "forces for prizing open" are concentrated on that part of the breakable portion 19 which is situated between the gripping part 16 and the groove 10, which means that the initial tearing up of the portion 19, which taken by itself requires force, is made easier. When the portion 19 has been torn up or broken up as far as the groove 10, the remaining part of the portion 19 is easily torn up at the same time as the disc 13 of aluminium foil is made to burst in the unsupported area 17, and the stopperlike part 1 is removed out of the emptying channel of the container 4 which is formed by the inside of the annular part 3 remaining in the container mouth.

Owing to the hingelike-attaching of the part 1 to the annular body 3 along the portion 11, the part 1 is not removed as an undesirable object of scrap, but can instead function as a guide to assist when the container 4 is to be re-closed. This is made possible in that the inner part of the gripping part 16 is provided with a catch 9 which is adapted so that it can engage under the flange 8 and retain the torn-up stopperlike part 1 in closing position.

As the aluminium foil disc 13 is to be protected in certain cases from making contact with the contents, because the taste of the contents may be affected by the metal and also because the metal foil disc 13 may be eaten away acids occurring in the contents. In these cases it is often not sufficient to coat the aluminium foil disc 13 with an outer protective layer of plastic, but the free edges or cut edges of the aluminium foil discs 13, which in general are exposed when the aluminium foil discs 13 are punched out of a sheet or weblike material, should also be protected. This problem is solved by the invention.

The depth of the annular recess 20 is at least as great as the thickness of the gastight disc 13, which in the case illustrated here comprises a central layer of aluminium foil 23 and outer coatings 24 and 25 of thermoplastics. During the punching operation, the disc 13 has been given such a dimension that it can be inserted with its outer edge portion 21 with a relatively good fit, into the recess 20. In the fixing or sealing operation the foil disc 13 is pressed with simultaneous heating of the edge portion 21, (e.g. by means of high-frequency heating) against the inside of the recess 20. When this is done the plastic coating 24, which may be constituted of polyethylene material, is fused together with the plastic material on the inside of the recess 20 so as to obtain a tight and mechanically durable join. At the same time plastic material is heated and pressed out from the end surface 28 of the lower part 14 of the annular body over the inner edge of the recess 20 and the edge portion 21 of the disc 13, so that a thin plastic layer 22 bridges the stamped

or cutted outer edge 29 of the disc 13 and is made to fuse together tightly with the outer plastic layer 25 of the disc 13. In the manner described the aluminium foil layer 23 of the disc 13 can thus be completely encapsulated and protected from contact with the contents.

It has been found, that at least in caps which have been subjected to pressure from pressurized contents over a prolonged period, the disc 13 is made to burst close to where it is fixed in the stopper-like part 1 when the cap is torn up. This is in general quite desirable, since a stopper part is obtained in this manner which is free from "flash" or projecting remains of the disc 13 when the stopperlike part 1 is withdrawn from the emptying channel. If desired, however, it is possible to direct the rupture line in the disc 13 by providing one or both of the plastic layers 24 or 25 with an incision or weakening line 31.

In accordance with Fig. 2 the cut outer edge 29 of the aluminium foil disc 23 is protected by heating the edge portion 21 of the gastight disc 13 in conjunction with the sealing operation. The plastic coatings 24 and 25 in the edge portion 21 of the disc are thereby made to melt and are caused by means of a compression jaw to flow out over the peripheral cut outer edge 29 of the aluminium foil disc 23 so that the latter is wholly "baked in" or enclosed along the whole of its perimeter by the edge portions of the coatings 24 and 25 joined to one another in the area of the outer edge 29 by fusion by plastic layer 22. It is possible to achieve this effect because under the influence of heat the plastic material can be pressed out easily over the edge 21 of the aluminium foil disc 23, whereas the aluminium foil layer itself is not deformed.

By the use of the cap in accordance with the invention, the gas tightness of known caps can be greatly improved whilst the price of the function of the cap is not affected to any appreciable degree.

## Claims

1. A cap for containers intended for the keeping of pressurized contents such as beer or refreshing beverages, which cap is adapted so that it can be fitted in and retained by the opening portion of the container, the said cap comprising a substantially tubular body (3) whose radial outside is provided with holding and sealing elements (7) for the gastight joining to and fixing at the opening portion of the container and whose inside forms a pouring channel for the contents of the container, and a stopperlike part (1) inserted into the said pouring channel and joined to the upper edge of the tubular body along a thin, readily breakable, annular zone, wherein a substantially circular disc (13) of metal foil is attached to the preferably plane end surface (15) of the stopperlike part (1) and to the edge zone of the lower

part (14) of the tubular body (3) along annular portions characterized in that the edge zone of the lower part (14) of the tubular body (3) is provided with an annular recess (20) whose diameter coincides with or slightly exceeds the diameter of the disc (13) which is fitted into said recess (20) and that the outer edge (29) of the disc (13) is completely encapsulated by a protective coating.

2. A cap in accordance with claim 1, characterized in that the outer edge (29) of the disc (13) is encapsulated in the recess (20) by virtue of the plastic material of the edge zone of the tubular body (3) having been deformed and pressed in over the outer edge (29) of the disc (13) in conjunction with the fixing of the aluminium foil disc.

3. A cap in accordance with claim 1 or 2, characterized in that both sides of disc (13) are coated with thermoplastic layers (24, 25) being joined together along the outer edge (29) of the disc (13) by fusion.

4. A cap in accordance with one of the preceding claims, characterized in that the cap and/or the thermoplastic layers (24, 25) are made of polyethylene.

5. A cap in accordance with claim 3 or 4, characterized in that an annular weakening (31) is arranged in at least one of the thermoplastic layers (24, 25) of the disc (13) along a desired rupture line.

6. A cap in accordance with one of the preceding claims, characterized in that the ratio A between the inside diameter of the annular portion (14) of the tubular body (3) and the outside diameter of the annular portion (15) of the stopperlike part (1) is between 1.2 and 2.

7. A cap in accordance with claim 6, characterized in that the said disc (13) is made of aluminium foil of a thickness T of about  $5 \mu\text{m} + 10 \cdot A \mu\text{m}$ .

#### Patentansprüche

1. Verschluß für zur Aufbewahrung von komprimiertem Füllgut wie Bier oder Erfrischungsgetränken bestimmte Behälter, wobei der Verschluß in den Öffnungsteil des Behälters einsetzbar ist und dort gehalten werden kann und aufweist einen im wesentlichen rohrförmigen Körper (3), dessen radiale Außenseite mit Halte- und Dichtungselementen (7) für die gasdichte Verbindung mit und Festlegung an dem Öffnungsteil des Behälters versehen ist und dessen Inneres einen Gießkanal für den Behälterinhalt bildet, und einen stopfenähnlichen Teil (1), der in den Gießkanal eingesetzt ist und mit dem oberen Rand des rohrförmigen Körpers entlang einer dünnen, leicht aufreißbaren Ringzone verbunden ist, wobei eine im wesentlichen kreisrunde Scheibe (13) aus Metallfolie an der bevorzugt ebenen Endfläche (15) des stopfenähnlichen Teils (1) und an der Randzone des unteren Teils (14) des rohrförmigen Körpers (3) entlang ringförmigen Ab-

schnitten befestigt ist, dadurch gekennzeichnet, daß die Randzone des unteren Teils (14) des rohrförmigen Körpers (3) mit einer ringförmigen Aussparung (20) versehen ist, deren Durchmesser demjenigen der Scheibe (13), die in die Aussparung (20) eingepaßt ist, entspricht oder diesen geringfügig übersteigt, und daß der Außenrand (29) der Scheibe (13) vollständig von einer Schutzbeschichtung umkapselt ist.

2. Verschluß nach Anspruch 1, dadurch gekennzeichnet, daß der Außenrand (29) der Scheibe (13) in der Aussparung (20) dadurch umkapselt ist, daß in Verbindung mit der Festlegung der Scheibe aus Aluminiumfolie der Kunststoff der Randzone des rohrförmigen Körpers (3) verformt und nach innen über den Außenrand (29) der Scheibe (13) gedrückt ist.

3. Verschluß nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß beide Seiten der Scheibe (13) mit thermoplastischen Schichten (23, 24) beschichtet sind, die entlang dem Außenrand (29) der Scheibe (13) durch Verschmelzen miteinander verbunden sind.

4. Verschluß nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Verschluß und/oder die thermoplastischen Schichten (24, 25) aus Polyethylen bestehen.

5. Verschluß nach Anspruch 3 oder 4, dadurch gekennzeichnet, daß in wenigstens einer der thermoplastischen Schichten (24, 25) der Scheibe (13) eine ringförmige Schwächung (31) entlang einer erwünschten Reißlinie angeordnet ist.

6. Verschluß nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß das Verhältnis A zwischen dem Innendurchmesser des ringförmigen Abschnitts (14) des rohrförmigen Körpers (3) und dem Außendurchmesser des ringförmigen Abschnitts (15) des stopfenähnlichen Teils (1) zwischen 1,2 und 2 liegt.

7. Verschluß nach Anspruch 6, dadurch gekennzeichnet, daß die Scheibe (13) aus Aluminiumfolie mit einer Dicke T von ca.  $5 \mu\text{m} + 10 \cdot A \mu\text{m}$  besteht.

#### Revendications

1. Fermeture pour récipients destinés à la conservation de contenus sous pression tels que de la bière ou des boissons rafraîchissantes, cette fermeture étant établie de façon qu'elle puisse être introduite et retenue dans l'embouchure du récipient, ladite fermeture comprenant un corps (3) essentiellement tubulaire, dont la partie radialement extérieure est munie d'éléments de maintien et de jonction (7) pour assurer la jonction étanche aux gaz et la fixation sur la partie ouvrante du récipient tandis que l'intérieur forme un conduit de versage pour le contenu du récipient, et une partie formant bouchon (1) introduite dans ledit conduit de versage et jointe à l'extrémité

supérieure du corps tubulaire le long d'une zone mince annulaire facile à rompre, dans laquelle un disque pratiquement circulaire (13) en feuille de métal est attaché à la surface d'extrémité de préférence plane (15) de la partie (1) formant bouchon et à la zone marginale de la partie inférieure (14) du corps tubulaire (3) le long de zones annulaires, caractérisée en ce que la zone marginale de l'extrémité inférieure (14) du corps tubulaire (3) présente un évidement annulaire (20) dont le diamètre est égal ou légèrement supérieur au diamètre du disque (13) qui est monté dans ledit évidement (20) et que le bord extérieur (29) du disque (13) est complètement encapsulé par un revêtement protecteur.

2. Fermeture selon la revendication 1, caractérisée en ce que le bord extérieur (29) du disque (13) est encapsulé dans l'évidement (20) par l'action de la matière plastique de la zone marginale du corps tubulaire (3) ayant été déformée et comprimée par dessus le bord extérieur (29) du disque (13) en conjonction avec la fixation du disque en feuille d'aluminium.

3. Fermeture selon la revendication 1 ou la revendication 2, caractérisée en ce que les deux

faces du disque (13) sont revêtues de couches thermoplastiques (24, 25) qui sont jointes ensemble le long du bord extérieur (29) du disque (13) par fusion.

4. Fermeture selon l'une quelconque des revendications précédentes, caractérisée en ce que cette fermeture et/ou les couches thermoplastiques (24, 25) sont un polyéthylène.

5. Fermeture selon la revendication 3 ou la revendication 4, caractérisée en ce qu'un affaiblissement annulaire (31) est disposé dans au moins l'une des couches thermoplastiques (24, 25) du disque (13) le long d'une ligne de rupture désirée.

6. Fermeture selon l'une quelconque des revendications précédentes, caractérisée en ce que le rapport A entre le diamètre intérieur de la partie annulaire (14) du corps tubulaire (3) et le diamètre extérieur de la portion annulaire (15) de la partie formant bouchon (1) est compris entre 1,2 et 2.

7. Fermeture selon la revendication 6, caractérisée en ce que ledit disque (13) est en feuille d'aluminium d'une épaisseur T d'environ  $5+10 \cdot A \mu$ .

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Fig. 1

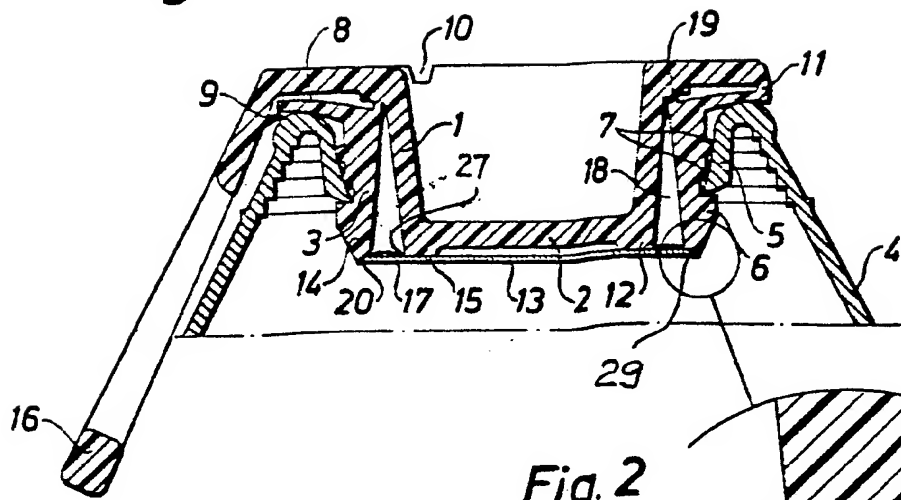


Fig. 2

